FATAL HÆMORRHAGE FROM TREPHINING.[1]

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It is generally considered that the operation of trephining *per se* is devoid of danger. The removal or temporary lifting of a considerable portion of the skullcap for purposes of exploration is undertaken without thought of involving life. It is believed that in direct proportion to the extent of the intracranial portion of an operation is the danger of serious hæmorrhage and shock increased. This is borne out by statistics. Thus, in the compilation of Haas of 122 operations for brain tumor, which were successful as regards the removal of a tumor, there was a mortality of 61 per cent. The death-rate is largely charged to shock and hæmorrhage.

In the two years 1900 and 1901 von Bergmann operated on four tumors with three deaths directly due to operation. That the hemicraniotomy, the opening of the skull by the large trap-door method, and the operating at one sitting are in part accountable for this high death-rate is probable. In the larger work of von Bergmann on brain surgery twelve deaths had been reported directly due to hæmorrhage. It is difficult to determine the proportion of cases in which excessive hæmorrhage came from the skull. Of 175 exploratory or palliative operations in which the tumor was not found or could not be removed, seventy-five ended fatally.

In the literature of the subject, deaths on the table have been often recorded without specific designation of the source of the bleeding. In brain tumors involving the dura and the bone capsule, excessive bleeding is to be expected. That changes in the diploic veins should occasionally take place is not strange, when one considers the relationship between the dural sinuses, the cortical meningeal veins, and the parasinoidal spaces as demonstrated by Cushing. In a personal communication from Dr. William Taylor, he states that he has seen only two of Dr. Keen's cases of dural tumor survive the operation. Hæmorrhages carried off the other cases in the course of a few hours.

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In a personal communication from Dr. Allen Starr, he reports a case operated upon at the Presbyterian Hospital for supposed cerebellar tumor. On stripping off the scalp, a large horseshoe incision having been made over the occiput, the hæmorrhage was severe. When the pericranium was exposed, a series of little holes in the skull was opened, from which venous blood poured out. The diploic veins connected with the lateral sinus. They were enormous and opened outward. The operation was discontinued, the hæmorrhage being controlled with difficulty by pressure. The patient recovered from the operation, but did not report subsequently.

In another case at the New York Hospital, Dr. Peabody exposed a fibroma, one inch beneath the cortex of the parietal region. Over this tumor the skull was reduced in thickness, so that it was not one-eighth of an inch thick over a region two inches in diameter. Here the man had felt pain, and the skull was exquisitely tender. But one inch of brain tissue of apparently normal consistency lay between the tumor and this thin skull. Dr. Starr further states that he has seen two cases of brain tumor in which the skull over the growth was thicker than elsewhere.

So far as my knowledge of the literature goes, no great changes in the skull have been depicted as secondary to subdural brain tumors, except for the involvement of the dura and overlying bone from extension of the disease. The following case of death from hæmorrhage from the bone only, and a description of the changes found on autopsy, may prove of interest.

Miss A. M.; aged thirty years; single. Entered Cincinnati Hospital December 22, 1902. The family history is negative. The patient has been well up to the present time, except for an

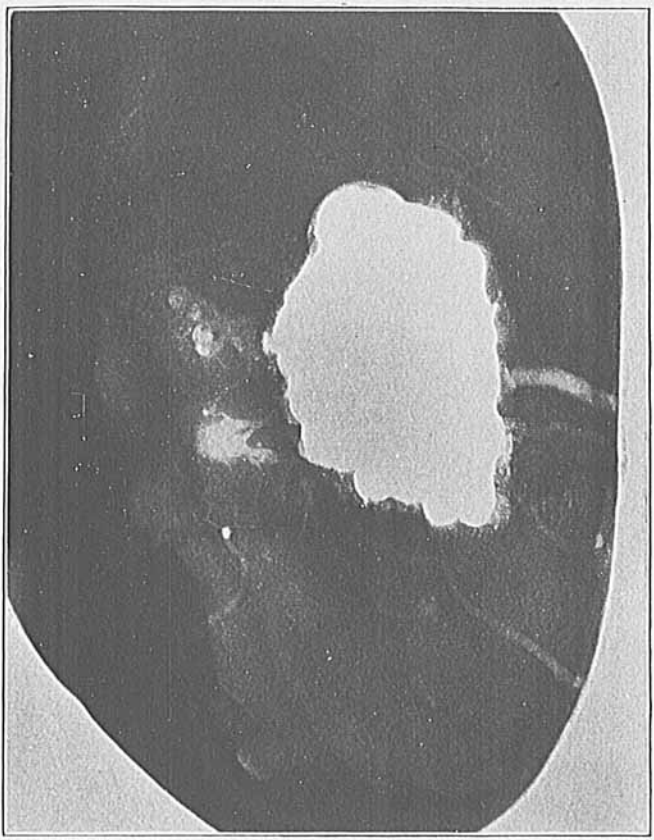

FIG. 1.—Radiograph showing enlarged parasinoidal spaces and parietal branch of anterior diploic veins.

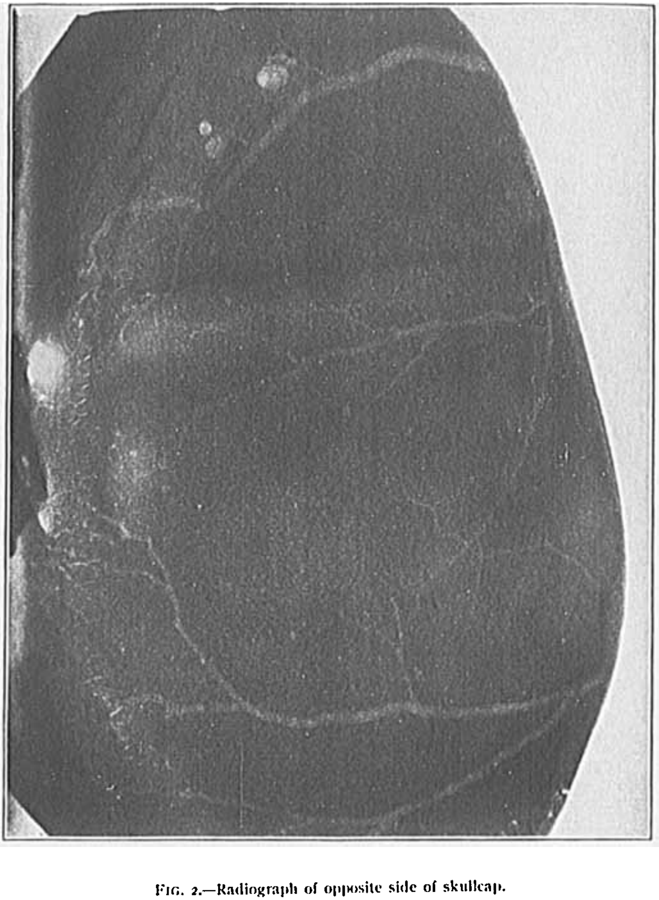

FIG. 2.—Radiograph of opposite side of skullcap.

attack of measles in childhood. Two years before admittance, patient began having epileptic seizures, in which the right arm would begin to tremble and contract. Then the right side of the face and the right leg would become rigid and tremble. The patient usually lost consciousness. These attacks occurred on an average of once a week. She was brought to the hospital several months ago, and the diagnosis of tumor in the left cortex was made. The patient refused operation and left the hospital. The fits continued to occur weekly.

Present Condition.—Patient of small stature, fairly developed and well nourished. On the face there is a typical iodine eruption. Heart sounds normal. Mentally the patient is fairly bright, but at times shows marked hebetude. She complains of almost constant headache. Movements of the eye normal. Reflex present both to light and accommodation, otherwise the examination is negative. The ophthalmoscopic examination made by Dr. Sattler shows typical papillitis, prominent swelling of optic-nerve entrance with exudation and hæmorrhage, œdema of the disc, œdematous infiltration of region of macula; likewise slight hæmorrhage. The papillitis, which has been present for a length of time, is beginning to recede and give way to optic atrophy.

During her stay in the house, a number of epileptic seizures were carefully observed. They began with pain in the right arm, which was a precursor of the attack. Within five minutes usually the pain increased, and the arm became rigid and trembled. The face and right lower extremity were next involved and became rigid. In a number of attacks, unconsciousness lasting for a varying length of time followed. During the attacks the pulse-rate increased to 120, but within an hour after its termination it was down to eighty-four.

Operation, January 28, 1903.—Morphia chloroform narcosis. The Rolandic fissure having been outlined, a large horseshoe-shaped incision of the scalp with lower base was made down to the bone. The bleeding from the scalp was not unusual. With the Kümmel electric drill, an opening was made through the skull. The bleeding was quite profuse. The smallest Sudek's fraise was next inserted, with a view of making an osteoplastic resection of the skull in the line of the scalp incision. About one inch of bone had been cut through, when it was evident that the profuseness of the hæmorrhage from the bone would prevent the completion of the operation by this method. The fraise was therefore removed, and bone wax was pressed into the line of the cut in the bone. The hæmorrhage was not thereby controlled. Compression of both carotids was likewise tried, but was of no avail. As speedily as possible, a large trephine opening was then made, the scalp and periosteum having been rapidly lifted from the bone. With rongeur forceps the bone was removed as rapidly as possible, in order to get at the source of the bleeding. In the mean time, the patient became blanched and pulseless. She died after the dura was exposed. The autopsy revealed a gliosarcoma the size of a small peach directly under the trephine opening. The tumor could easily have been lifted out from between the convolutions. It was not adherent to the dura. The original intention to operate at two sittings was frustrated by the death on the table from hæmorrhage from the bone. The skullcap was removed, and the following changes noted by Dr. A. V. Phelps, Professor of Anatomy in the University of Cincinnati (Fig. 3), who was kind enough to make a very careful study of the effects on the bone of the marked disturbance of the intracranial venous circulation.

Report of Dr. Phelps.—" The groove for the lodgement of the superior longitudinal sinus, anterior to a point midway between the lambdoid and coronal sutures, is much widened, being four centimetres wide on the frontal bone, where it should be a mere trace. The margins of the groove are scalloped, showing where the much distended lacunæ laterales of Keys and Retzius pressed upon the bone.

" Posterior to the point above taken and almost opposite to the posterior pole of the trephine opening, the groove for the longitudinal sinus abruptly narrows, being one centimetre, and appears normal. Anterior to the transverse plane of the above point, lateral to groove and in the groove for the sinus, are numerous openings, greatly enlarged foramina, through which the dural veins and the diploic veins anastomose.

" The most remarkable changes, however, are the bony canals for the diploic veins. This change is almost limited to the left side, the side of operation. Remembering that the occipital diploic veins are much the largest, and noting that in the specimen they are normal, their opening may be used as a standard of comparison.

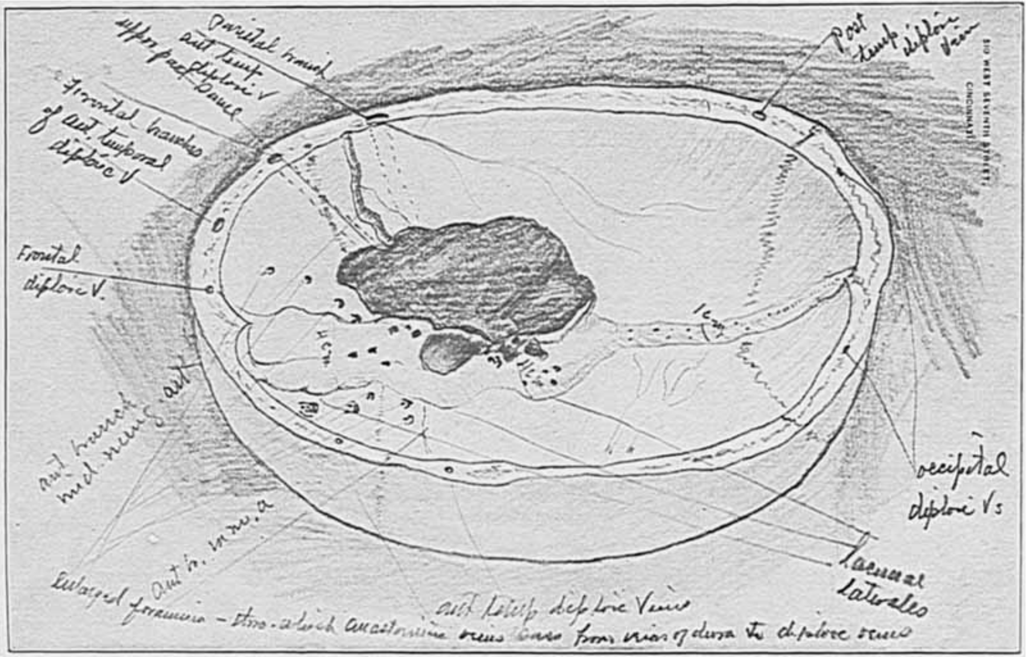

FIG. 3.—Inner surface of skullcap. (Phelps.)

"1. The frontal diploic canal of the left side, usually very small, is as large as the occipital.

"2. The canals carrying the frontal branches of the anterior temporal diploic veins are two millimetres in diameter, and appear to be five times as large as the occipital. The bony tables over them are so thinned that one can trace the canals. They open on the edges of the trephine opening.

"3. One canal, the parietal branch of the anterior temporal diploic vein, is five millimetres in diameter, and appears to be ten to twelve times as large as the occipital. Its coverings are almost transparent, and it opens directly in the margin of the trephine opening, having crossed the field of operation.

"4. The posterior temporal diploic canal is about four times as large as the occipital.

"5. On the right side, only the temporal canals for diploic veins are enlarged, and to about the size of the normal occipital only.

"About opposite the middle of the trephine opening and just to the left of the sagittal suture, the bone is so thinned as to be transparent. It would appear that the growth interfered with the flow through the superior longitudinal sinus, and the veins of the dura and their lacunæ laterales became distended. The anterior temporal diploic vein anastomoses with the dural veins, and empties by coming out through the great wing of the sphenoid, entering one of the deep temporal veins. It would appear that this great diploic vein became the principal channel of collateral circulation.

"The left diploic veins were more enlarged, because the dural veins with which they anastomosed were directly pressed upon as well as the sinus. Fewer of the meningeal veins anastomosing with the posterior temporal diploic vein were pressed upon, therefore its enlargement is less than that of the anterior. It empties either through the mastoid opening or goes inward to the lateral sinus."

These changes in the blood channel of the diploe are shown in the accompanying illustrations (Figs. 1, 2, and 3).

In the case reported, the first symptoms manifested themselves two years before the operation. The growth, therefore, was rather rapid in its development, and therefore marked changes in the diploic veins must be considered as very unusual. From the very nature of things, it is impossible to predict such a complication in a contemplated operation for brain tumor, except when it is evident that dural tumors have infiltrated the bone. In these cases hæmorrhage is to be expected. That the increased general intracranial pressure from clearly subdural tumors, as in the above case and that mentioned by Starr, is capable of inducing marked dilatation of the diploic veins and the parasinoidal lacunæ must be borne in mind. It certainly accounts for the greater hæmorrhage during the operation of trephining for tumor than for other pathologic conditions.

The case presented was the first in which I attempted the use of the electric fraise, with the intention of doing an osteoplastic resection. While it is impossible to be certain that the result would have been different had I adopted the older methods of operating with trephine and chisel, I am quite certain that valuable time was lost in getting at the source of the bleeding. Posture of the head and compression of the carotids availed nothing.

In a few cases recorded, among them one of my own, the ligation of the carotid was made necessary by the profuseness of the bleeding. It is difficult to see how, in a case like the one recorded, anything short of tying both carotids would have availed. This patient was dead from hæmorrhage before the carotid could have been exposed.